

Analysis of Maillard Reaction using ATR fiber (Non-Enzymatic Browning Reaction)

Introduction

Maillard reaction, which was discovered by Louis-Cammille Maillard in around 1912, is a representative example of the reaction between food components, and is well known as a non-enzymatic browning reaction of amino compounds and sugar (Figure 1). This time, the process of Maillard reaction is analyzed by FT/IR using ATR fiber.

Experimental

Ribose, maltose, and trehalose aqueous solutions (3 mol/L) were each mixed with a β -alanine aqueous solution (3 mol/L), and then each mixture was heated at 80°C for 30 minutes while measuring the IR time-course spectra.

Results and Discussions

Figure 3 is a photo showing sample solutions of pre and post reaction. A strong non-enzymatic browning reaction was verified in ribose and also small reaction appeared even in maltose. On the other hand, only nonreducing sugar, trehalose was not experiencing non-enzymatic browning reaction.

Figure 4 shows the IR time-course spectra of each type of sugar. A decrease in peak intensity in the vicinity of 1050cm^{-1} , attributing to $-\text{COC}-$, and an increase in peak intensity of five-membered ring was verified in ribose and maltose. The IR time-variance of these absorbances almost corresponds to the visual changes seen by eyes. It is supposed that ultimate products have been formed because sugars rings were opened by Maillard reaction. In case of trehalose, intensity of all peaks was just increased. This is considered to be due to adsorption of sample to ATR prism, or concentration change caused by water evaporation, and Maillard reaction was not experienced.

By using ATR fiber, the chemical reaction like the above-mentioned can be monitored or analyzed in real time.

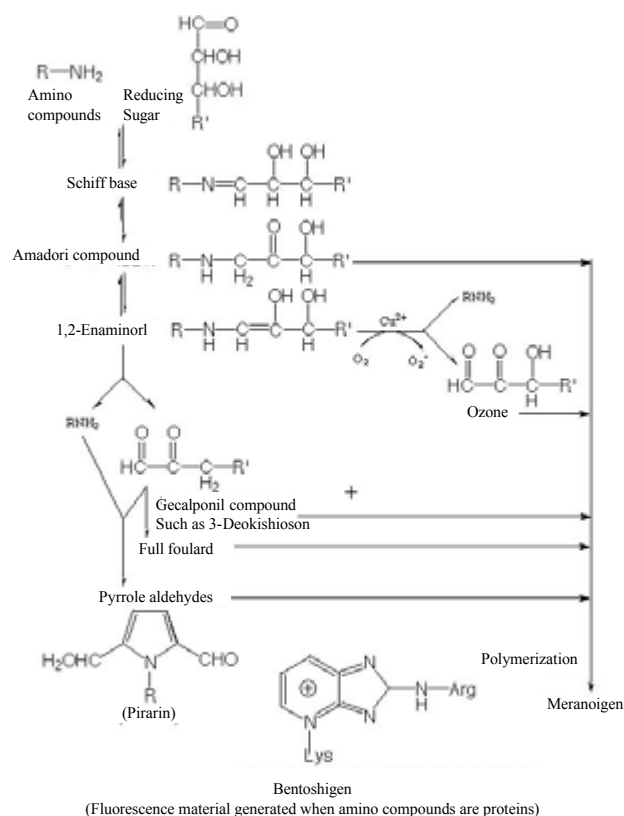


Fig. 1 Maillard reaction

Condition

Instrument:	VIR-9500
Fiber:	Calcogenait ATR (ZnSe)
Detector:	MCT
Accumulation:	32 times
Measurement time:	30 minutes
Measurement interval:	45 seconds



Fig. 2 Measurement method

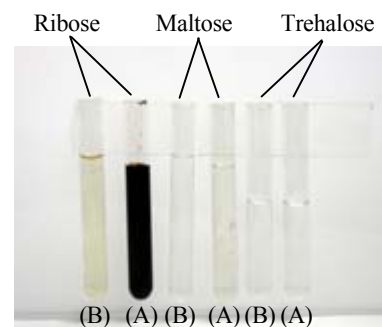


Fig. 3 Photo of sample solution before (B) and after (A) reactions

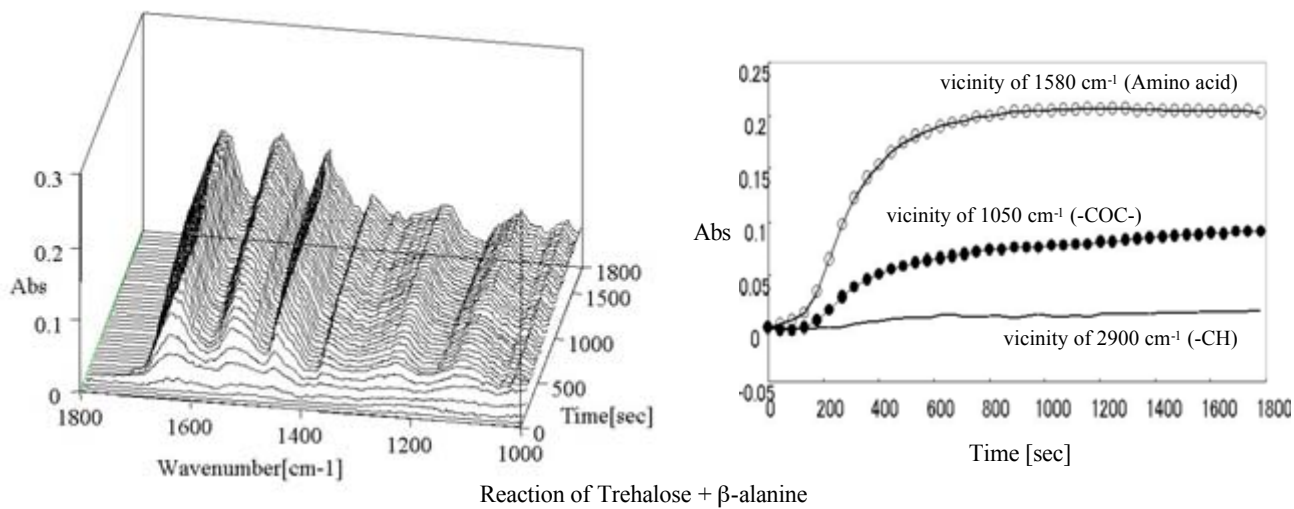
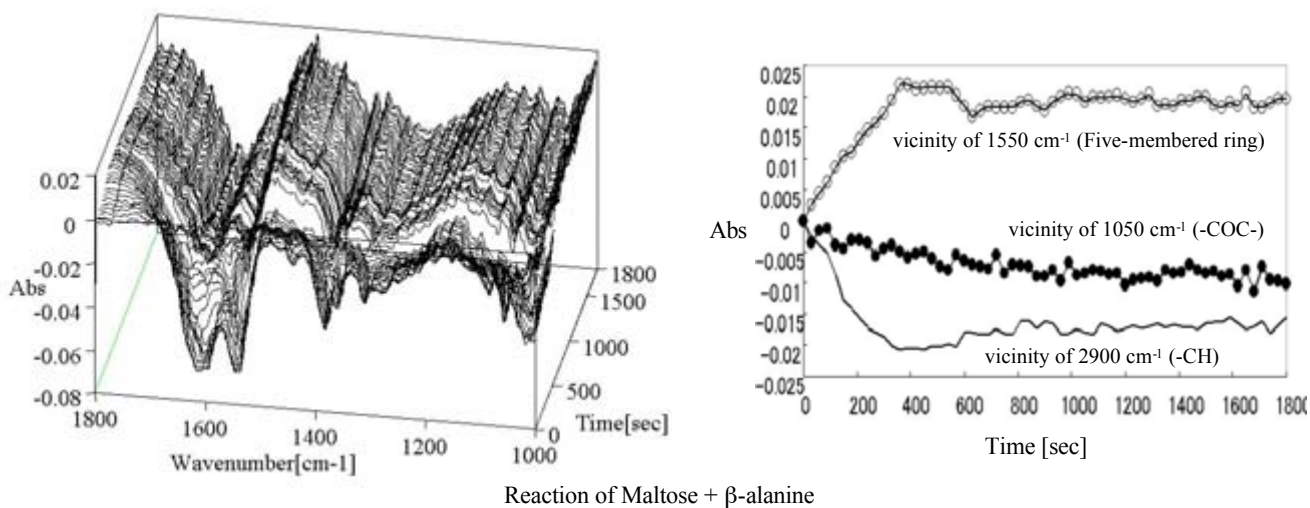
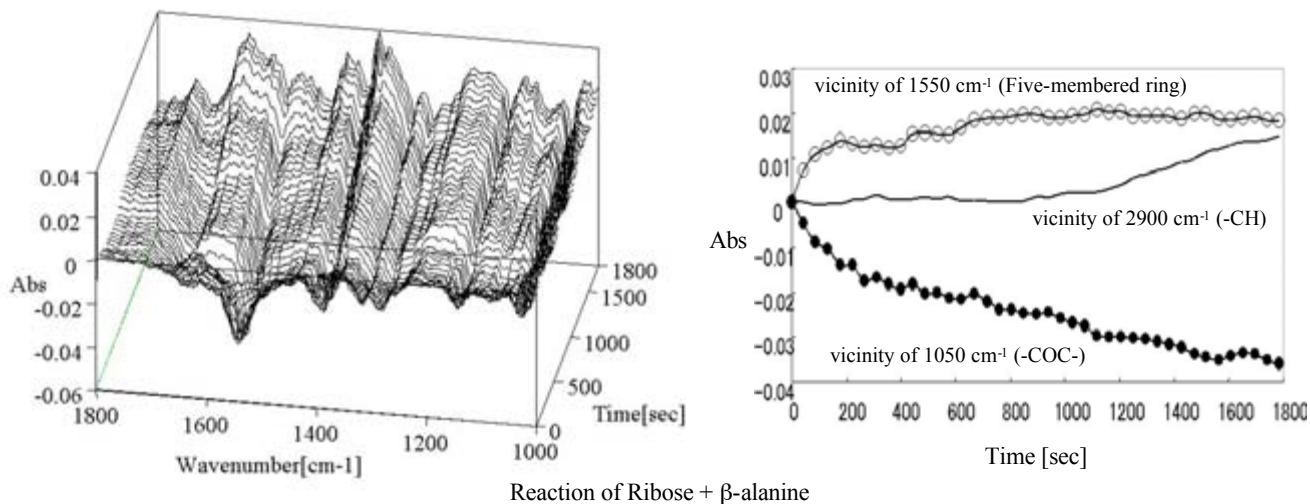


Figure 4 Time-course spectra of Maillard reaction